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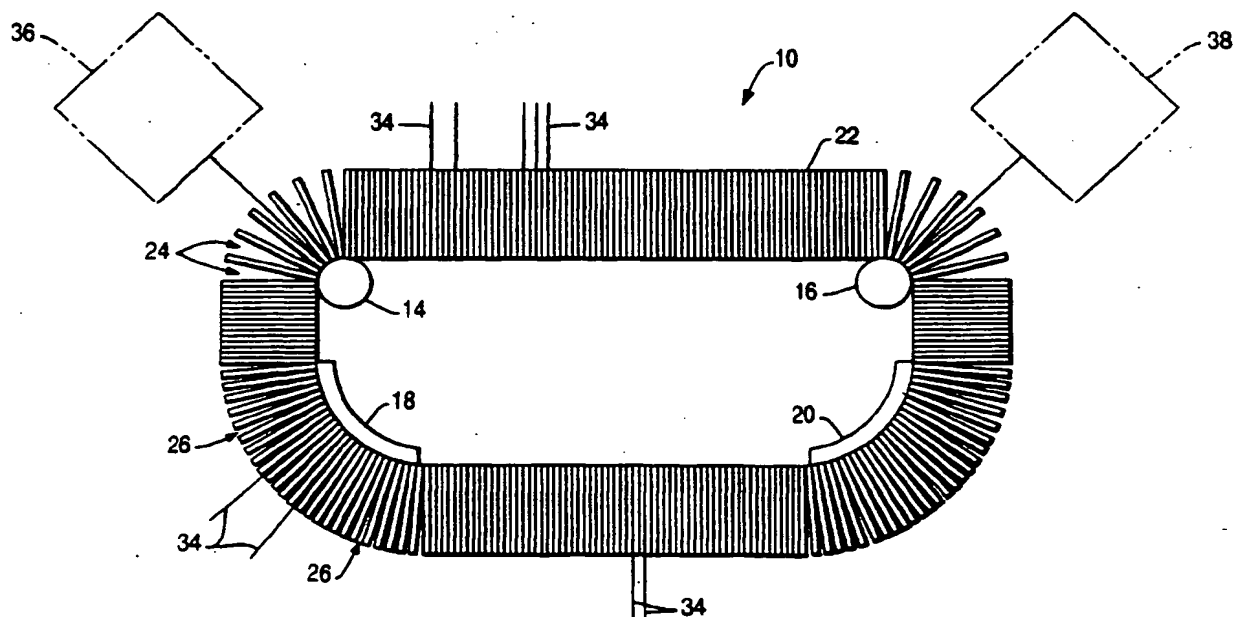
(54) **Escrow storage device**

(57) A currency note storage device (10) for an ATM (50) comprises an endless rubber belt (12) carrying a multiplicity of outwardly-projecting flaps (22), the edges of the flaps attached to the belt being contiguous; the belt (12) runs around a pair of rollers (14,16) of such diameter that as the belt runs over them, the outer edges of the flaps are spread apart to form slots; the belt also runs around a pair of guides (18,20) of such diameter

that as the belt runs over them the flaps are barely spaced apart.

The number of slots is known, and therefore each slot is addressable; the processor (62) of the ATM (50) records the value of the currency note in a slot, and controls a stepper motor (66) to drive the belt (12) so that a required bank note (34) is positioned adjacent a pick device (38). The device (10) can also be used to deposit currency notes in an ATM.

**FIG. 2**



**EP 0 841 643 A1**

## Description

This invention relates to an escrow storage device, that is, a temporary store from which single sheets of paper, such as bank notes, can be retrieved. The device may be used in a financial self-service terminal, such as an Automated Teller Machine (ATM).

It is known to provide an ATM having the facility to accept bank notes, cheques, bills for payment etc., and to place them in an escrow storage area, usually a cassette, but it is not easy to re-use the deposited notes without human intervention. Usually the notes have to be sorted into bundles of identical denomination before reuse.

It is the object of the invention to provide an escrow storage device providing the facility to identify and retrieve individual bank notes and the like.

According to the invention there is provided a storage device for sheets of paper characterized by an endless belt of resilient material carrying on its outer surface a multiplicity of outwardly-projecting flaps, the edges of the flaps adjacent the belt being contiguous; support means to support the inner surface of the belt; and drive means to drive the belt around the support means; a first part of the support means being of smaller radius than other parts of the support means so that when the inner surface of the belt passes over said first part, the outer edges of the outwardly-projecting flaps are spread apart.

Preferably the storage device is provided with identification means to identify each slot between adjacent flaps, and recording means to record the identity of a paper sheet placed in an individual slot, for example the value of a bank note.

The invention will now be described by way of example only with reference to the accompanying drawings in which:-

Figures 1(a) and 1(b) are respectively a schematic view and a schematic end view of the storage device;

Figure 2 illustrates a storage device in operation;

Figure 3 illustrates a pick device for the storage device;

Figure 4 illustrates an ATM incorporating the storage device; and

Figure 5 illustrates a control system for the ATM of Fig.4.

In Fig.1 a storage device 10 according to the invention comprises an endless rubber belt 12 running around a pair of relatively small diameter rollers 14,16 and a pair of relatively large diameter steel guides 18,20. On the outer surface of the rubber belt are a multiplicity of

outwardly projecting rectangular flaps 22. One edge of each flap is attached to the belt 12 and the number of flaps and their thickness is selected so that, at the attached edges, the flaps are contiguous.

As the belt passes over the rollers 14,16, the edges of the flaps remote from the belt are spaced apart; the term "relatively small diameter" is used to indicate a substantial spreading of the flaps, to provide tapered slots 24 into which individual sheets, e.g. paper sheets or bank notes, can be inserted. As the belt passes over the steel guides 18,20, slight spreading of the flaps occurs; the term "relatively large diameter" is used to indicate a slight spreading of the flaps, as shown at 26, which is sufficiently small for any sheet between the flaps to be retained, whatever the orientation.

Between the rollers 14,16 and between the guides 18,20 the flaps 22 are essentially close-packed and parallel, and close packing also occurs between roller 14 and guide 18, and between roller 16 and guide 20, as illustrated at 28. The end view Fig.1(b) shows the tapered slots 24, close packed area 28, and the slight spreading 26.

Fig.1(b) also shows a pair of spaced guides 30 between which the flaps 22 are positioned, and a drive shaft 32 attached to the roller 16.

The spreading of the flaps 22 to form tapered slots 24 is assisted by the resilience of the rubber of the belt 12; the outer surface of the belt stretches slightly as it passes over the smaller diameter rollers 14,16.

In Fig.2, the storage device 10 is shown in operation with a number of bank notes 34 held between the flaps 22. The device is arranged with the rollers 14,16 horizontal, and the guides 18,20 spaced below the rollers. In the horizontal sections of the belt 12 between the rollers 14,16 and between the guides 18,20, the flaps 22 are tightly packed and the notes 34 are held firmly, even when held upside down between the guides 18 and 20. As the belt passes around the guides 18,20 the flaps spread slightly but the bank notes are still held in position.

As the belt passes over the roller 14, a bank note can be inserted into each slot 24 by an insertion device 36 shown schematically. As the belt passes over the roller 16, bank notes can be retrieved by a pick device 38 shown schematically.

One example of the pick device 38 suitable for use with a storage device 10 is shown in Fig.3. In Fig.3(a), a bank note 34 is shown supported by a flap 22 as it passes over the roller 16. Adjacent the projecting end of the note 34 is a pair of wedge-shaped rotary grippers 40 each pivoted about a pivot point 42, positioned toward the narrow end of the respective wedge. The wedges are rotatable by first drive means (not shown). The thick end of each wedge has a convex surface 46, and the pivots 42 are spaced so that, at the point of rotation where the convex surfaces 46 are adjacent, they are just in contact.

On the opposite side of the grippers 40 to the bank

note 34 is a pair of rollers 44 rotatable about their central axes by drive means (not shown).

When the note 34 is to be picked by the pick device 38, the grippers 40 are rotated in opposite directions, as indicated by the arrows A in Fig. 3(b), so that their convex surfaces 46 contact opposite surfaces of the note 34, and draw it away from the flap 22 towards the rollers 34, which receive the note.

To place a bank note in position on a flap 22, the mechanism may be operated in reverse.

The storage device according to the invention may be used in a financial self-service terminal such as an ATM 50 shown in Fig. 4. The ATM has a display screen 52, key pad 54, user card insertion slot 56, cash delivery slot 58, and cash deposit slot 60.

In an ATM, it is essential to deliver the correct sum of money requested by the user, and the storage device according to the invention allows a single device to store and permit accurate retrieval of mixed denomination notes. Since the number of slots on the device 10 is known, i.e. the spaces between the flaps 22, each slot can be regarded as addressable: bank notes of known denomination can be delivered to a known address, and therefore a sum made up of mixed denomination notes can be retrieved by driving the belt by a stepper motor so that slots containing notes of the required denomination are stopped adjacent the pick device 38.

A control system for the ATM 50 allowing such a facility is shown in Fig. 5. A processor 62 within the ATM 50 controls the display means 52, key pad 54, a card reader 64 connected to card input slot 56, and to a dispense means 66 connected to the cash dispense slot 58, all of which are conventionally provided.

The processor 62 also controls a stepper motor 66 connected to the drive shaft 32 of the storage device 10 (see Fig. 1), to a pick drive 68 connected to the pick device 38, and to a deposit drive 70 connected to the insertion device 36.

As the slots of the storage device 10 are loaded with bank notes by the insertion device 36, the processor 62 retains in its memory a record of the value of the bank note in each addressable slot of the device 10. When a user of the ATM requests the withdrawal of a sum of money, the processor selects the slot nearest to the pick means 38 having the required notes, and drives the stepper motor 72 so that the storage device 10 stops with each required note in turn adjacent the pick device 38, which picks the notes and delivers them to the dispense slot 58 by known arrangements.

For an ATM with a cash deposit facility 60, deposited notes can be sorted, validated, and inspected for reusable quality by conventional means. The reusable notes are supplied to the insertion device 36, which inserts a single note into each available addressable slot of the storage device 10; the processor 62 records the address and the value of each inserted note, so that the notes can then be reused.

## Claims

1. A storage device for paper sheets (34) characterized by an endless belt (12) of resilient material carrying on its outer surface a multiplicity of outwardly-projecting flaps (22), the edges of the flaps adjacent the belt being contiguous; support means (14, 16, 18, 20) to support the inner surface of the belt (12); and drive means (32) to drive the belt around the support means; a first part (14 or 16) of the support means being of smaller radius than other parts (18, 20) of the support means so that when the inner surface of the belt passes over said first part, the outer edges of the outwardly projecting flaps (22) are spread apart.
2. A storage device according to claim 1 characterized by first and second parts of the support means (14, 16) being of said smaller radius, the outer edges of the flaps (22) being spread apart as the belt passes over either support means.
3. A storage device according to claim 2 characterized by the first and second support means comprising a pair of rollers (14, 16) of relatively small radius, there being further provided a pair of curved guides (18, 20) of relatively large radius.
4. A storage device according to any preceding claim characterized by further comprising pick means (38) adjacent the outer edges of the flaps (22) as they pass around the first part of the support means (16).
5. A storage device according to any preceding claim characterized by further comprising insertion means (36) adjacent the outer edges of the flaps (22) as they pass around the first support means (14).
6. A storage device according to any preceding claims characterized by further comprising identification means (62) arranged to identify each slot between adjacent flaps (22), and recording means (62) to record the identity of a paper sheet (34) placed in an individual slot.
7. A storage device according to any preceding claim characterized by the endless belt (12) being a rubber belt.
8. A financial self-service terminal comprising a processor (62), a display (52), an input device (54), a card reader (64), a banknote storage device, and banknote dispense means (66), characterized in that the bank note storage device comprises an endless belt (12) of resilient material carrying on its outer-surface a multiplicity of outwardly-projecting

flaps (22) the edges of the flaps adjacent the belt being contiguous; support means (14,16 18,20) to support the inner surface of the belt (12); and drive means (32) to drive the belt around the support means; a first part (14 or 16) of the support means being of smaller radius than other parts (18,20) of the support means so that when the inner surface of the belt passes over said first part, the outer edges of the outwardly projecting flaps (22) are spread apart.

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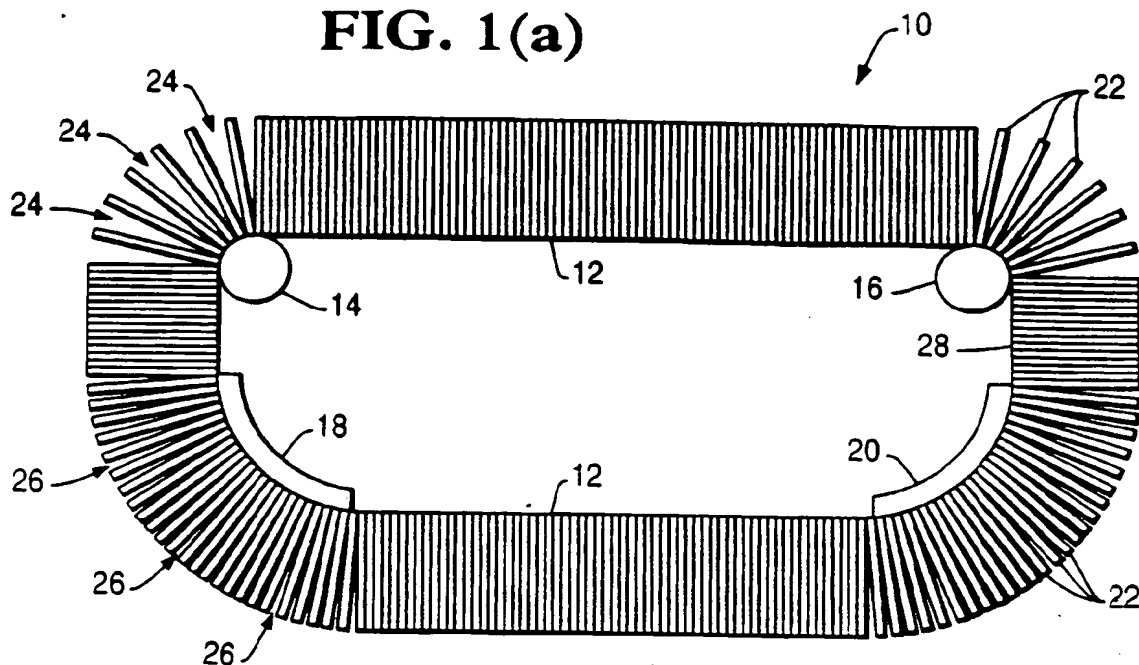
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**FIG. 1(a)**



**FIG. 1(b)**

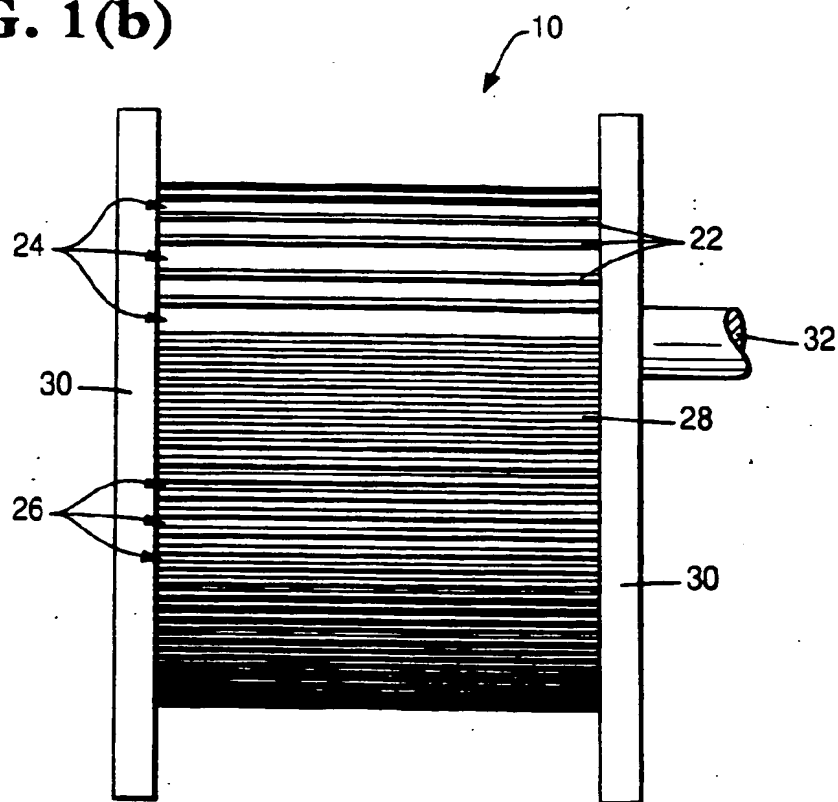
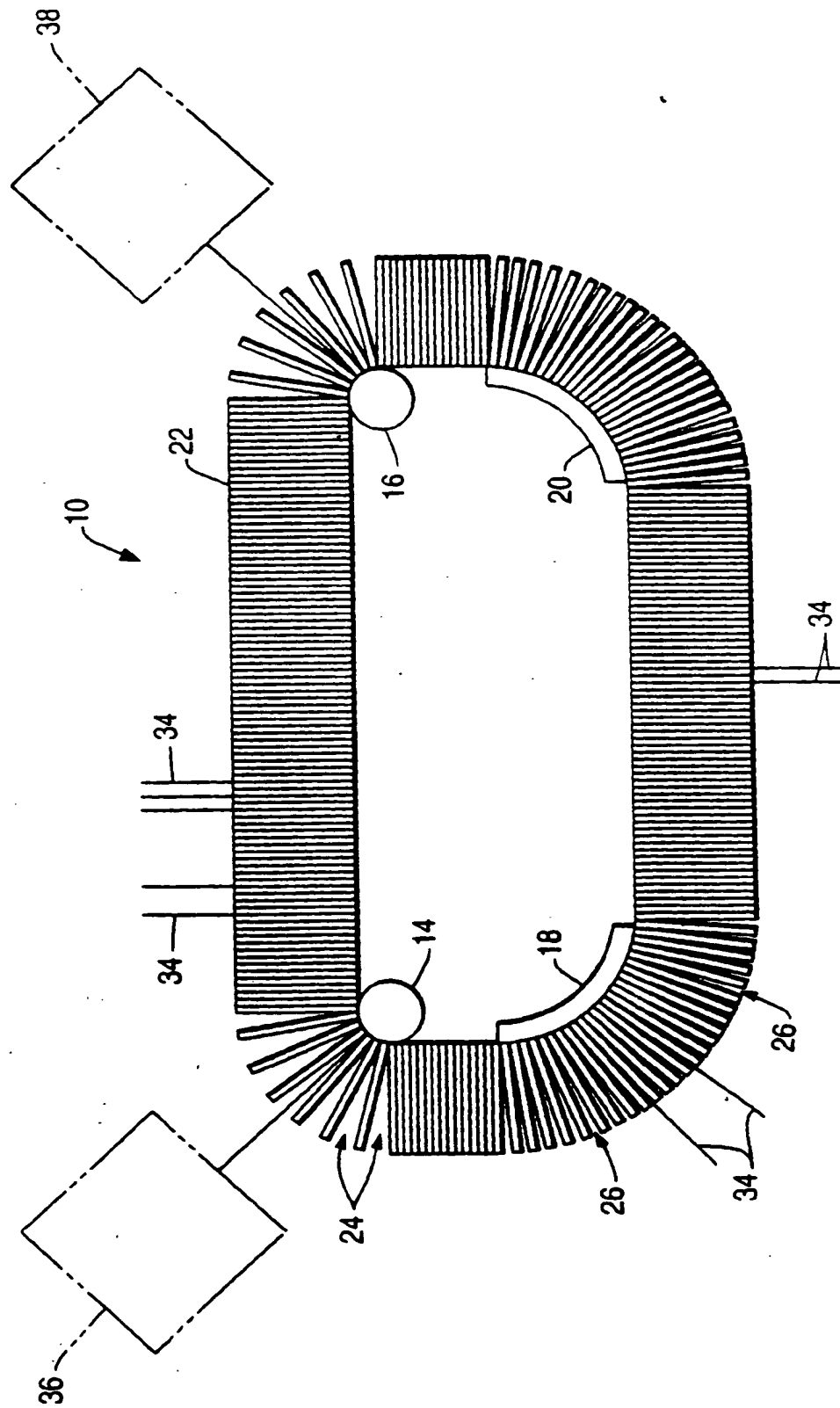
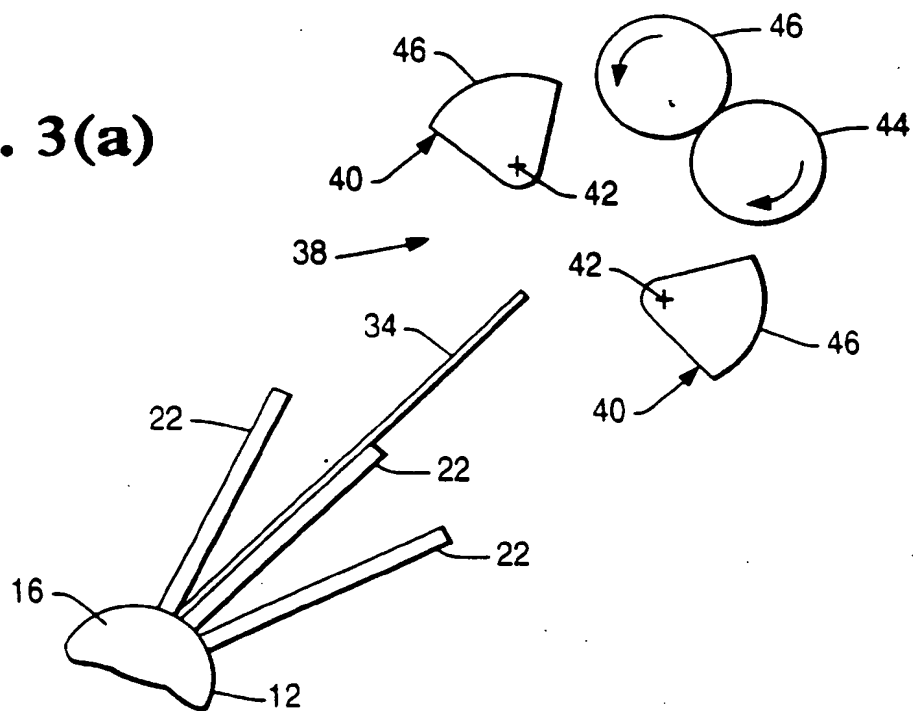


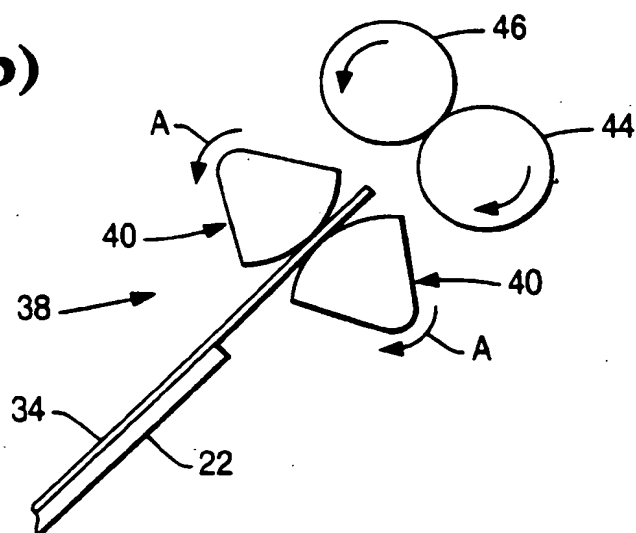
FIG. 2



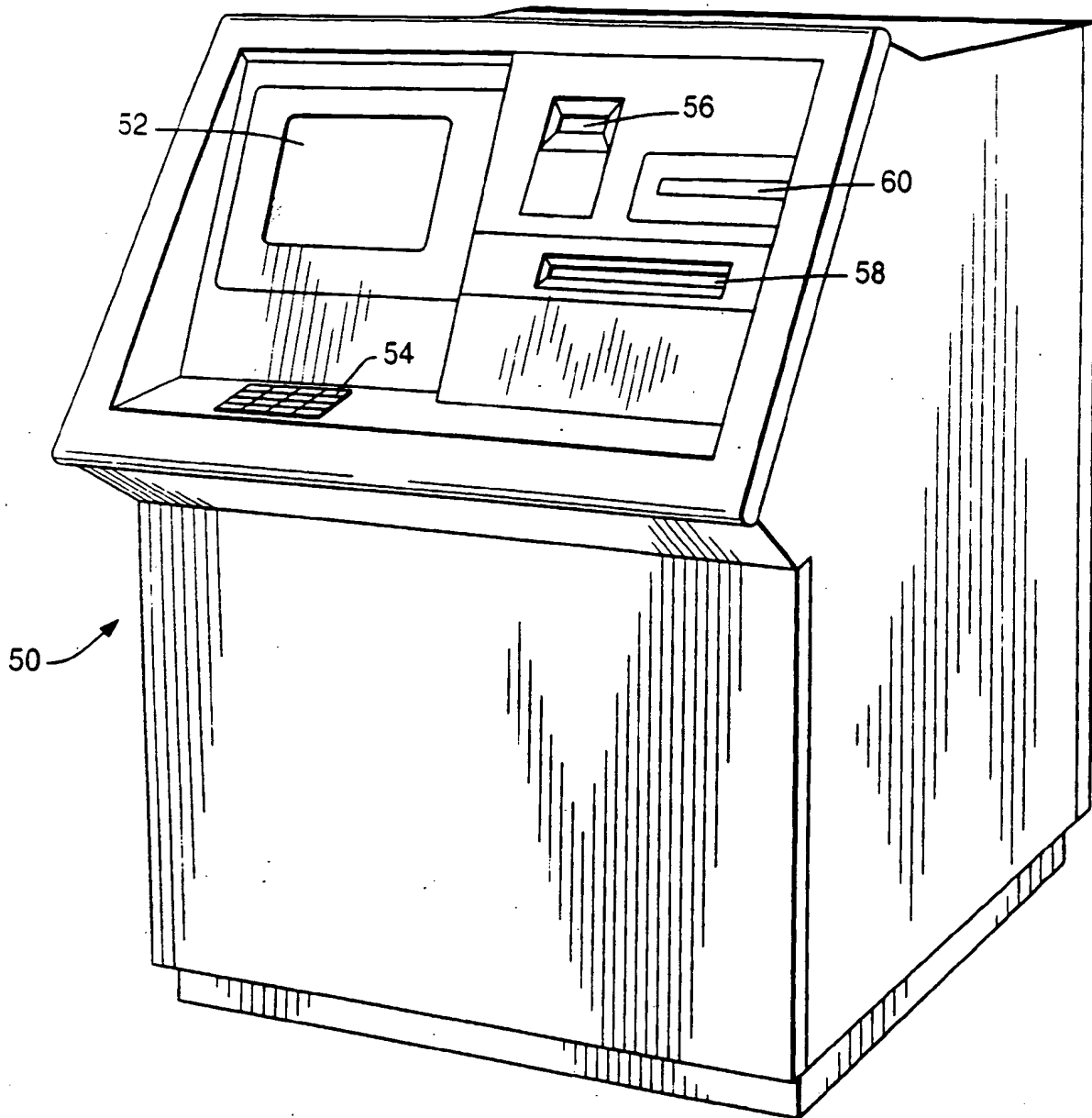
**FIG. 3(a)**



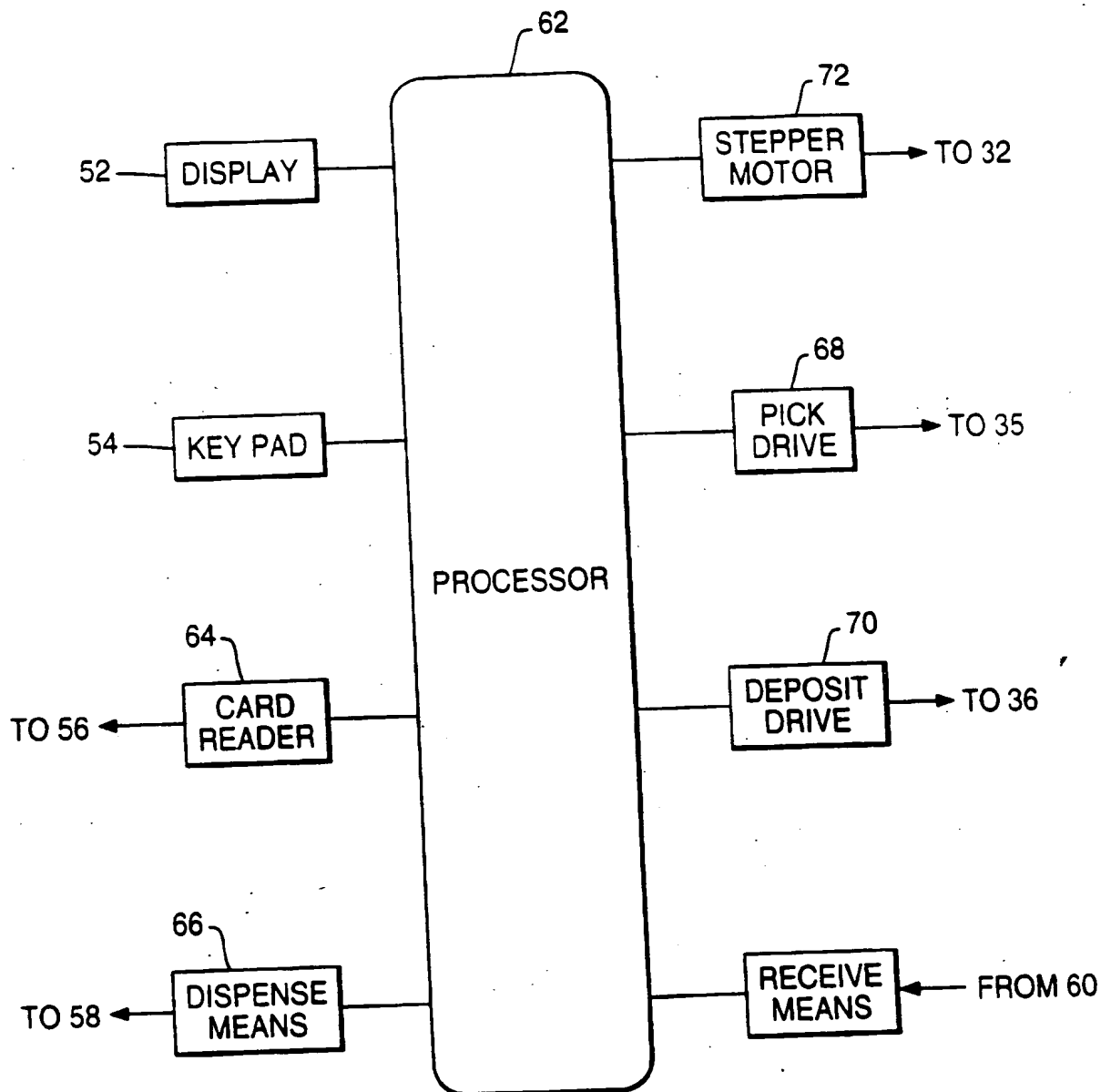
**FIG. 3(b)**



**FIG. 4**





**FIG. 5**



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 97 30 8018

| DOCUMENTS CONSIDERED TO BE RELEVANT                        |   |   |  |
|--|---|---|--|
| Category   | Citation of document with indication, where appropriate, of relevant passages   | Relevant to claim   | CLASSIFICATION OF THE APPLICATION (Int.Cl.8) |
| Y  | C.J. ROACH: "transport mechanism for cash dispenser"<br>IBM TECHNICAL DISCLOSURE BULLETIN,<br>vol. 18, no. 8, January 1976,<br>pages 2652-2653, XP002057669             | 1.4.5.7.<br>8   | G07D11/00<br>G07D9/00                        |
| A  | ---   | 2.3   |  |
| Y  | EP 0 163 977 A (SCHÖNING)   | 1.4.5.7.<br>8   |  |
| A  | * page 6, last paragraph: figures 1-3 *   | 2.3   |  |
| A  | EP 0 604 880 A (M.I.B. ELECTRONICA)<br>* column 5, line 30 - line 39; figures 1-6 *   | 1-4.6.8   |  |
| A  | A.YAMANOI: "automatic teller machine with a single bill stacker"<br>IBM TECHNICAL DISCLOSURE BULLETIN,<br>vol. 27, no. 5, October 1984,<br>pages 3073-3074, XP002007322 | 1.6.8   |  |
|  |   |   | TECHNICAL FIELDS SEARCHED (Int.Cl.8)         |
|  |   |   | G07D<br>B65G<br>B65H<br>B41F                 |
| The present search report has been drawn up for all claims |   |   |  |
| Place of search<br><b>THE HAGUE</b>                        |   | Date of completion of the search<br><b>4 March 1998</b>   | Examiner<br><b>Neville, D</b>                |
| CATEGORY OF CITED DOCUMENTS                                |   | T: theory or principle underlying the invention<br>E: earlier patent document, but published on, or after the filing date<br>D: document cited in the application<br>L: document cited for other reasons<br>S: member of the same patent family, corresponding document<br>X: particularly relevant if taken alone<br>Y: particularly relevant if combined with another document of the same category<br>A: technological background<br>O: non-written disclosure<br>P: intermediate document |  |